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Systematic Study of Subfamily Melanotinae (Coleoptera, Elateridae) from Korea I. The Genus *Melanotus* Eschscholtz

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Abstract In a systematic revision of the subfamily Melanotinae (Elateridae; Coleoptera) 18 species are revised in Korea. Among them, 11 species of the genus *Melanotus* are recognized, including two new species, *M. chejuensis* sp. nov. and *M. coreanus* sp. nov. Photos of adult male and their genitalia and key to the genera and species are given.

Key words Coleoptera, Elateridae, *Melanotus*, taxonomy, Korea

INTRODUCTION

The subfamily Melanotinae is a homogeneous group with seven genera, belonging to the family Elateridae, one of the largest families within Coleoptera with about 29,000 described species. Of them, over 300 species mostly in the genus *Melanotus* Eschscholtz have been recorded throughout the world except New Zealand (Stibick, 1979; Hayek, 1990). Adults of most species are between 5-20mm in length and yellow-brown, red-brown, dark brown or black in colour. Some species have considerable variations in colour of head, prothorax, elytra and abdomen.

Adults are usually found on the ground, under bark, and also on flowers and foliage of plants. They are able to fly and some of them are attracted to lights. Larvae live in decaying woods and under ground. Many species within this group are known as serious agricultural pests all over the world. A number of *Melanotus* species are known to cause damages to the roots of cereal, forage and other crops (Hyslop, 1915; Jansson *et al.*, 1988; Riley *et al.*, 1979; Riley *et al.*, 1984; Teruya, 1984).

The subfamily Melanotinae is easily recognized by the pectinate tarsal claws (Fig. 1a), but the study within this group is not easy because most species have homologous external characters. For this reason, taxonomic works of this group have been relatively hindered and many synonyms were produced.

Relatively small number of elaterid species have been recorded from Korea, in comparison with that of adjacent countries with only few taxonomic studies (Table 1). Only eight species have been reported by

the European scientists in late 19th century and Japanese entomologists in the early 20th century. Most Korean specimens investigated during that time were deposited in the Museums in European countries or Taiwan, and furthermore some of them have been lost.

Table 1. Comparison of species number of the Elateridae and the Melanotinae with those of her adjacent countries.

Country	Elateridae	Melanotinae	Reference
Korea	81	7	ESK & ESAE, 1994
Japan	647	52	Hirashima, 1989
China	174	21	Wu, 1937
Taiwan	151	21	Miwa, 1934

For the study of Korean Melanotinae, the informations on the fauna of her adjacent countries including Japan and China are essentially needed. Japanese source of informations and specimens are available from Kishii (1977, 1989 and 1991), Suzuki (1983, 1984, 1985 and 1988) and Ohira (1967, 1970, 1971 and 1992) and an Italian specialist, Platia (1991, 1993a and 1993b), who has studied this taxon extensively.

The first record on Melanotinae from Korea, was made by Kolbe (1886), who reported 6 elaterid species including *Melanotus propexus* Motschulsky, based on the collection of Gottsche.

Heyden (1887) reported 15 elaterid species including four Melanotine species; *M. piger* Motschulsky (=*Spheniscosomus cribricollis* (Faldermann)), *M. restrictus* Candèze (=*S. cribricollis* (Faldermann)), *M. annosus* Candèze and *M. nuceus* Candèze. Okamoto (1924) reported *Melanotus annosus* Candèze with 3 elaterid species from Cheju Island.

Miwa (1927, 1933a, 1933b, 1933c, 1934) examined numerous specimens collected from Japan, Korea and Sakhalin. He reported 30 species of Elateridae, including following 7 species of Melanotinae; *Spheniscosomus piger* Motschulsky (=*S. cribricollis*), *S. restrictus* Candèze (=*S. cribricollis*), *Melanotus annosus* Candèze, *M. erythropygus* Candèze, *M. legatus* Candèze, *M. nuceus* Candèze, and *M. propexus* Candèze in the section III 'Fauna of Corea' of his paper (1934). Most of Miwa's collection including some type materials, possibly all of the species described from the East Asia are preserved in the Agricultural Research Institute, Taipei, Taiwan.

Additionally, one more species, *Spheniscosomus cete* Candèze, was reported by Ishii (1940). Since then, no more species of the subfamily Melanotinae has been added to Korean fauna, even though many species of Elateridae were reported in various faunistic papers.

In the recent publication 'The Check list of Insects' which was published by the Entomological Society of Korea & Korean Society of Applied Entomology (1994), seven species of Melanotinae, including *Melanotus* (*Cratonychus*) *castanipes matsumurai* and *M. cete*, were listed.

Recently, Lee (1995) reported two species (*Priopus ferrugineipennis* and *M. carbonarius*) from Cheju-do as new to Korean fauna. Lee (1998) and Lee & Woo (1999) described 6 new species; *M. suwonensis*, *M. niger*, *M. augustianus*, *M. hallasanae*, *M. insularis* and *M. woonhahi*.

Therefore, a total of 16 species within the subfamily Melanotinae have been recorded from Korea (Table 2).

Table 2. A synopsis of taxonomic research on the subfamily Melanotinae in Korea.

Author	Year	Species newly added to Korean fauna	
Kolbe	1886	*Melanotus propexus* Candèze	
Heyden	1887	*M. nuceus* Candèze, *M. piger* Mot. (=*Spheniscosomus cribricollis* (Faldermann)), *M. restrictus* Candèze (=*S. cribricollis* (Faldermann))	
Miwa	1933	*M. annosus* Candèze, *M. legatus* Candèze	*M. erythropygus* Candèze,
Ishii	1940	*M. cete* Candèze (=*S. cete* (Candèze))	
ESK & ESAE	1994	*M. (Cratonychus) castanipes matsumurai* (Schenkling)	
Lee	1995	*Priopus ferrugineipennis* (Miwa),	*M. carbonarius* Candèze
Lee	1998	*M. suwonensis* Lee, *M. hallasanae* Lee,	*M. niger* Lee, *M. augustianus* Lee
Lee & Woo	1999	*M. insularis* Lee & Woo,	*M. woonhahi* Lee & Woo

MATERIAL AND METHODS

A total of 1,173 specimens of the subfamily Melanotinae from nation-wide collections in Korea was examined in this study. Among them, the bulk of specimens were collected by authors and his colleagues of the Division of Entomology, the National Institute of Agricultural Science and Technology (NIAST) and preserved in the Insect Collection of NIAST. Click beetles were collected generally by insect net or beating quadrangle sheet, and some were collected by the light traps controlled by Rural Guidance Offices in different 22 localities during 1992 and 1993.

A part of specimens were also borrowed and examined from other three collections: College of Agriculture and Life Sciences, Seoul National University (SNU), Suwon, Kyungpook National University (KPNU), Taegu, and Center for Insect Systematics (CIS), Kangwon National University, Chuncheon.

Abbreviations of provincial names of Korea were used in this paper as follows; HB: Hamgyeongbug-do, HN: Hamgyeongnam-do, PB: Pyeonganbug-do, PN: Pyeongannam-do, HH: Hwanghae-do, GW: Gangweon-do, GG: Gyeonggi-do, CB: Chungcheongbug-do, CN: Chungcheongnam-do, GB: Gyeongsangbug-do, GN: Gyeongsangnam-do, JB: Jeonrabug-do, JN: Jeonranam-do, JJ: Jeju-do. Following abbreviations are also used for description; BL/BW (body length/body width), L/W (length/width), M/L (median lobe/lateral lobe).

SYSTEMATICS

Subfamily Melanotinae Jakobson, 1913

Adults. Head capsule oval, deflexed, mouthparts inferior, frons ridged above and between antennae (may be obsolete in middle) (Fig. 1e); prosternum normally arcuate anteriorly; scutellum various, never

cordate, may be slightly excavate anteriorly; mesocoxae open to mesepimeron but closed to mesepisternum; meso- and metasternum distinct, joined by a definite suture; tarsi simple, without pads, but rarely 3rd segment broadened to receive 4th; claws prominently pectinate and without basal setae (Fig. 1a).

Key to Genera of Subfamily Melanotinae in Korea

1. Pronotum with basal lateral incision; the posterior angles of prothorax truncate at apex (Fig. 2f) in ventral view; prosternal suture more or less canaliculate (Fig. 2b); basal plate of hind legs weakly and gradually enlarged inwardly but not dentate at the center of posterior margin (Fig. 1b) 2
- Pronotum without basal lateral incision; the posterior angles of prothorax pointed sharply in ventral view (Fig. 2e); prosternal suture not canaliculate (Fig. 2a); basal plate of hind legs strongly enlarged inwardly and dentate sharply at the center of margin ..... *Priopus* Castelnau
2. Prosternal process horizontal, never bent inwardly (Fig. 2d) ..... *Spheniscosomus* Schwarz
- Prosternal process bent more or less inwardly behind the coxal plate of fore leg (Fig. 2c) 3
3. Anterior part of prosternal suture excavated weakly; body generally slender, long and flattened; the last segment of maxillary palpus weak axe-shaped ..... *Cratonychus* Dejean
- Anterior part of prosternal suture excavated deeply; the last segment of maxillary palpus strong axe-shaped ..... *Melanotus* Eschscholtz

Genus *Melanotus* Eschscholtz, 1829 빗살방아벌레속

Melanotus Eschscholtz, 1829: 32.
Perimecus Dillwyn, 1829: 32.
Menalotus Brullé, 1832: 136 (Inadvertent error).
Dodecactenus Candèze, 1889: 102.
Cremnostethus Schwarz, 1902: 197.
Tenalomus Fleutiaux, 1933: 234 (as a subgenus of *Melanotus*).
Kensakulus Chujo & Ohira, 1965: 24 (as a subgenus of *Melanotus*).
Natomelus Dolin, 1979: 71.
Apotonychus Motschulsky, 1859: 359.
Perimeces Scudder, 1882: 253.

Pronotum with lateral incisions basally. In ventral view, posterior angles of prothorax truncate at apex. Inner margin of hypomeron with a well-defined, narrow impunctate border separated from rest of hypomeron by a distinct groove or raised above it. Pronotosternal suture not sinuated at base of a groove but inner border of hypomeron may slope mesodorsad within anterior two-thirds of its length to form a shallow channel or groove; inner wall of groove, formed by the lateral margin of the prosternum, punctured. Ventral surface of last visible abdominal sternite without large punctures or pits near apex. Third tarsal segment simple, vertically or obliquely truncate distally (if a small ventral prolongation or lobe

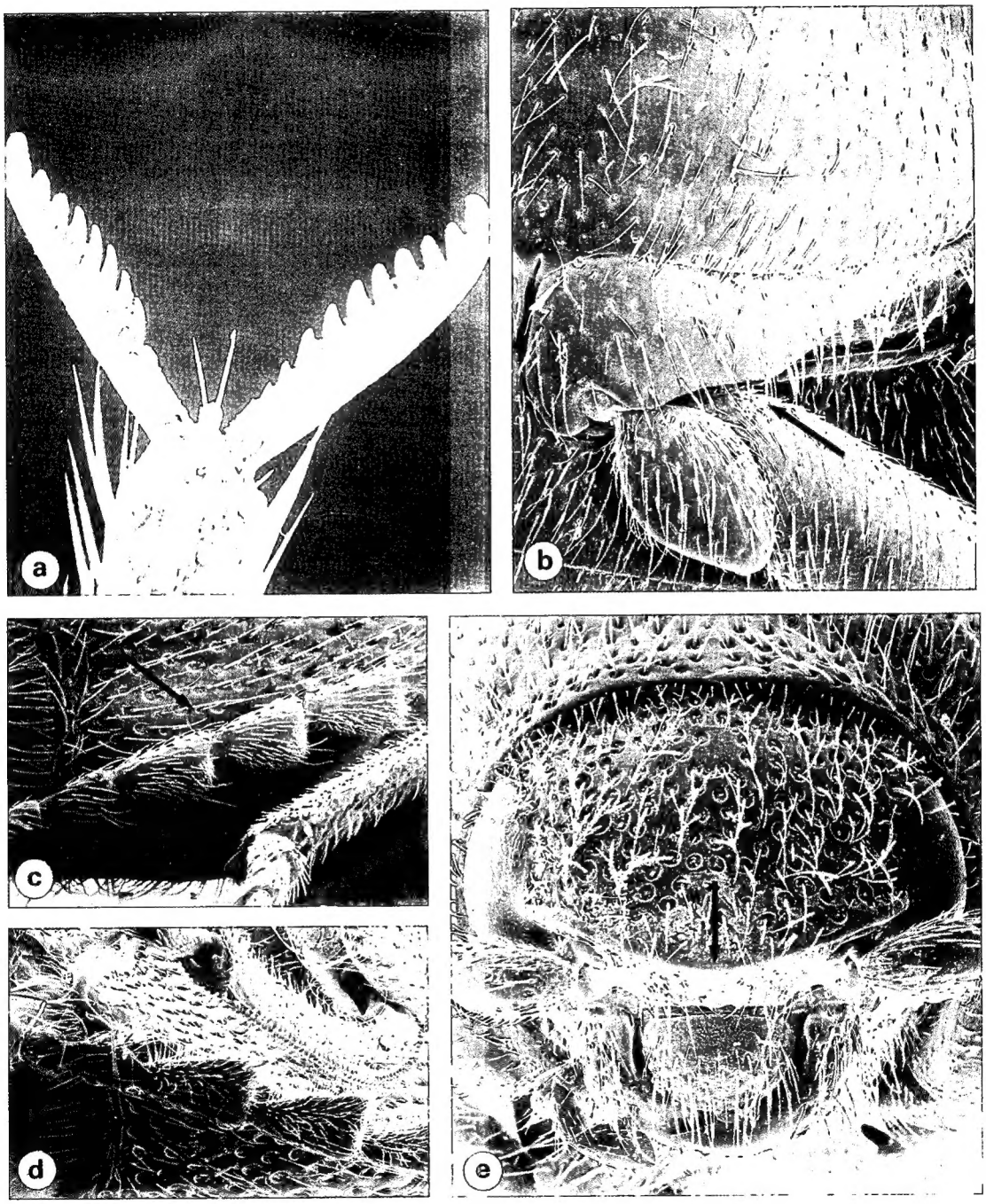

Fig. 1. Electron micrographs of genus *Melanotus*: a. claw of hind leg (*M. coreanus* sp. nov.); b. coxal plate of hind leg (*M. coreanus* sp. nov.); c. female antennal segments 2–6 (*M. suwonensis*); d. male antennal segments 2–6 (*M. suwonensis*); e. anterior aspect of head (*M. coreanus* sp. nov.).

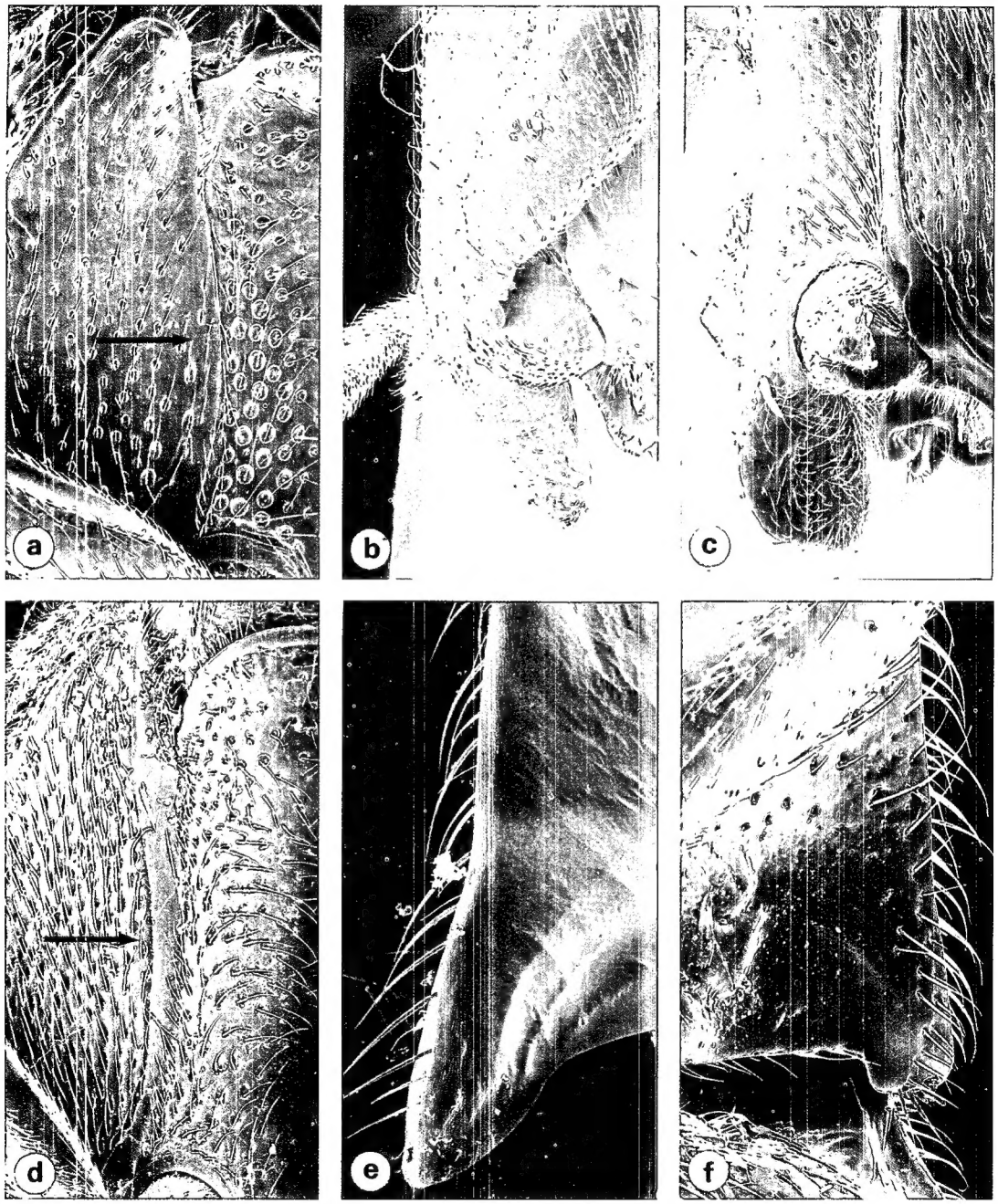

Fig. 2. Electron micrographs of genus *Melanotus*: a–b. ventral aspect of prothorax (prosternal suture) (a: *Priopus ferrugineipennis*, b: *Spheniscosomus cribricollis*); c–d. lateral view of prosternal process (c: *M. legatus*, d: *M. cete*); e–f. ventral view of hind angle of pronotum (e: *Priopus ferrugineipennis*, f: *M. coreanus*).

is present it does not extend beneath the entire length of 4th segment).

The length of the junction between the mesepimeron and mesosternum varies from one species to

another but up to the present no species has been found in which the junction is as short as in the majority of *Priopus* species. All the species also display the following character state: the nasale is simple or with a raised median area, never with a vertical carina or two confluent carinae forming an inverted 'Y' and antennae without a carina on one or both faces of fourth and some or all following segments although in a few species a smooth sparsely punctured longitudinal area on some segment may mislead the observer into believing that a carina is present. Lateral margins of prothorax each have a carina extending from posterior to anterior angle.

Remarks. The Schenkling's catologue (1927) lists over 200 valid species and almost 100 nominal species as synonyms in six nominal genera now included in *Melanotus*. Over 100 species have been described since the publication of the catalogue. Ohira (1971) divided this genus as four different subgenera, *Spheniscosomus*, *Cratonychus*, *Melanotus*, and *Kensakulus*, but those subgeneric names have not commonly accepted. In this paper, we do not employ the subgeneric rank.

Key to the species of genus *Melanotus* in Korea

1. Antennal segment 2nd and 3rd short and small, but segment 3rd slightly elongate, slender and longer than segment 2nd; total length of segment 2nd and 3rd equal to or longer than the segment 4th. Body longer than 12 mm in length 2
- Antennal segment 2nd and 3rd very small, oval and equal in length; total length of segment 2nd and 3rd shorter than the segment 4th. Body shorter than 12 mm in length 11
2. Total length of antennae long, at least last segment extending the base of the hind angles of pronotum. Body and elytra blackish brown or reddish brown entirely 3
- Antennae very short, never attaining the base of the hind angles of pronotum. Body and elytra black entirely 7
3. Total length of antennal segment 2nd, 3rd longer than the 4th 4
- Total length of antennal segment 2nd, 3rd shorter than the 4th 6
4. Pronotum trapezoid, sides subparallel at least basal half, gradually convergent anteriorly. Lateral lobe simple without apical barb (Fig. 4b) ..... *M. suwonensis*
- Pronotum gradually convergent anteriorly, lateral sides rounded. Lateral lobe armoured with apico-lateral barb 5
5. Body slender and reddish brown colour, smaller than 16mm in length. The apico-lateral barb of parameres in male genitalia well developed (Fig. 4a) ..... *M. legatus*
- Body robust about 16 mm in length and blackish brown colour. The apico-lateral barb of parameres in male genitalia developed weakly, prothorax rather longer than wide (Fig. 4c) ..... *M. propexus*
6. Pronotum convex above, lateral sides subparallel, medio-longitudinal length as long as the with in the middle, body length about 12-13 mm ..... *M. insularis*
- Pronotum somewhat flattened above, lateral sides subparallel at basal half and then gradually convergent anteriorly (Fig. 3d) ..... *M. augustianus*
7. Body convex above, sides of pronotum subparallel at least basal half 8
- Body somewhat flattened above, sides of pronotum gradually convergent anteriorly from the base to

anterior end 10

8. 15 mm in length, lateral sides parallel. Pronotum shining with medio-longitudinal furrow ..... *M. annosus*

- Smaller than or equal to 12 mm. Pronotum punctated strongly without medio-longitudinal furrow 9

9. About 12 mm in length. Body black wholly with legs and antennae blackish brown. Apico-lateral barb of male genitalia hooked strongly in lateral (Fig. 4i) ..... *M. carbonarius*

- 11 mm in length. Body black wholly with legs and antennae redish brown ..... *M. woonhahi*

10. Pronotum thickly covered with ocellated punctures, sides subparallel at basal half. Distributed in Korean Peninsula (Fig. 3c). Colour black, but legs and antennae blackish brown ..... *M. niger*

- Pronotum gradually convergent anteriorly. Male genitalia with a elongate apico-lateral expansion in lateral lobe. In general, male genitalia larger and more robust than previous species. Distributed in Island Cheju, specially Mt. Hanra (Fig. 3f). Colour black wholly ..... *M. hallasanae*

11. The antennal segment 3rd longer than the 2nd. Body slender, sides subparallel. Generally last two segment of abdomen reddish brown in ventral view. Body length about 9 mm ..... *M. erythropygus*

- Antennal segment 2nd and 3rd same in length, and bolbous 12

12. Punctures of pronotum indistinct and small. Antennal segment 4th to 10th more slender and narrow. Apical barbs of lateral lobe hooked bluntly (Fig. 3h) ..... *M. chejuensis* sp. nov.

- Punctures of pronotum distinct and large. Antennal segment 4th to 10th serrate moderately. Apical barbs of lateral lobe hooked sharply ..... *M. coreanus* sp. nov.

***Melanotus suwonensis* Lee, 1998** 수원빗살방아벌레

(Figs 1c, 3b, 4b)

Melanotus suwonensis Lee, 1998: 103-108.

Specimen examined. NIAST: GG- 1♂, Suweon, 25. VI. 1969; 9♂, ditto, 4-22. V. 1991; 15♂, ditto, 1-15. VI. 1991; 12♂, 5♀, ditto, 2-23. VII. 1991; 1♂, ditto, 8. VIII. 1991; 7♂, ditto, 21-30. V. 1992; 8♂, ditto, 3-15. VI. 1992; 7♂, 2♀, ditto, 2-16. VII. 1992; 2♂, ditto, 26. VIII. 1992; 15♂, 1♀, ditto, 20-31. V. 1993; 14♂, ditto, 4-18. VI. 1993. CN- 1♀, Nonsan, 1. VII. 1991.

Distribution. Korea (Central).

Remarks. This beetle can be distinguished from *M. legatus* by its broad pronotum and the simple parameres of lateral lobe of male genitalia.

***Melanotus propexus* Candèze, 1881** 복판빗살방아벌레

(Figs 3c, 4c)

Melanotus propexus Candèze, 1881: 89; Kolbe, 1886: 199; Heyden, 1887: 257; Mochizuki, 1937: 82.

Specimens examined. NIAST: PN- 3♂, 1♀, Mt. Myogo, 14-15. VIII. 1993.

Distribution. Korea and China.

Remarks. This species was described as a new species by Candèze (1881) from China. Kolbe (1886) reported this species from Korea for the first time. But we couldn't examine any specimens of this species from the southern part of Korea and the specimens of Kolbe (1886) and Heyden (1887) were unavailable now. However, we examined four specimens collected from Mt. Myogo, northern part of Korea in 1993.

***Melanotus legatus* Candèze, 1829** 빗살방아벌레

(Figs 2c, 3a, 4a)

Melanotus legatus Candèze, 1860: 323; Miwa, 1927: 112; 1933: 158; 1934: 102 & 166; Mochizuki, 1937: 82; Narita, 1939: 45; Ishii, 1940: 47; Chu, 1969: 113; Kim *et al*., 1975: 17; Yoon & Nam, 1978: 82; Lee *et al*., 1985: 407; Kim *et al*., 1991: 180.

Melanotus laticollis Motschulsky, 1860: 9.

Melanotus annosus sensu Okamoto, 1924: 182.

Melanotus legatus legatus: Hirashima, 1989: 327.

Melanotus (*Melanotus*) *legatus*: Ohira, 1971: 23.

Specimens examined. NIAST: HN- 1♂, Shakuoji (Seogwangsa, Anbyeon), 8. X. 1921; 1♂, ditto, 24. V. 1922; 1♂, ditto, 23. VII. 1924. GW- 1♂, Onseiri (Onjeong-ri, Mt. Geumgang), 5. VII. 1924; 3♂, Yangyang, 3. VI. 1992. GG- 2♂, Anseong, 24. VI. 1987; 1♀, Mt. Cheonggye, 4. VII. 1981; 1♂, Mt. Gwanggyo, 13. V. 1983; 1♂, Gwangreung, 28. VI. 1980; 1♂, Icheon, 1. V. 1993; 34♂, ditto, 8-19. VI. 1993; 1♂, Mt. Myeongji, 11. V. 1989; 1♂, Namyang, 20. V. 1993; 1♂, Mt. Suri, 7. VI. 1968; 1♂, Mt. Taehwa, 14. VII. 1991; 1♂, Suweon, 18. VI. 1923; 2♂, ditto, 24-27. VI. 1924; 1♂, ditto, 22. VI. 1925; 1♂, ditto, 11. VIII. 1925; 2♂, ditto, 7-16. VI. 1926; 2♂, ditto, 21-27. VI. 1927; 1♂, ditto, 18. VI. 1929; 1♂, ditto, 21. VI. 1931; 3♂, ditto, 13-21. VI. 1958; 1♀, ditto, 7. VII. 1959; 1♂, ditto, 15. VI. 1960; 2♂, ditto, 16-22. V. 1963; 3♂, ditto, 17. V. 1968; 3♂, ditto, 9-15. VI. 1968; 3♂, ditto, 12-27. VI. 1969; 1♂, ditto, 3. VII. 1969; 2♂, ditto, 14. VI. 1974; 1♂, ditto, 23. VII. 1974; 1♂, ditto, 14. VIII. 1974; 4♂, ditto, 4-22. VI. 1976; 2♂, ditto, 14. VII. 1976; 1♂, ditto, 3. VIII. 1976; 2♂, ditto, 4. VIII. 1980; 5♂, ditto, 23. VI. 1981; 1♀, ditto, 10. V. 1983; 1♂, ditto, 9. VI. 1983; 6♂, 1♀, ditto, 1. VII. 1983; 2♂, ditto, 15-16. V. 1984; 2♂, 1♀, ditto, 14-29. VI. 1984; 1♂, ditto, 28. VII. 1984; 1♂, ditto, 17. V. 1988; 14♂, 1♀, ditto, 4-31. V. 1991; 72♂, 5♀, ditto, 1-29. VI. 1991; 34♂, 10♀, ditto, 1-20. VII. 1991; 7♂, ditto, 8. VIII. 1991; 17♂, 3♀, ditto, 14-31. V. 1992; 66♂, 5♀, ditto, 1-30. VI. 1992; 54♂, 26♀, ditto, 2-30. VII. 1992; 1♂, ditto, 26. VIII. 1992; 9♂, ditto, 20-31. V. 1993; 3♂, ditto, 8-9. VI. 1993; 43♂, 7♀, ditto, 11-26. VI. 1993. CB- 2♂, Goesan, 25. VII. 1992. CN- 2♂, Cheonan, 16. VI. 1992; 19♂, Gongju, 21. VI. 1991; 1♂, ditto, 6. VII. 1991; 1♂, ditto, 1. IX. 1991; 35♂, 1♀, ditto, 1-24. VI. 1992; 2♂. ditto, 1-26. VII. 1992; 2♂, ditto, 15. V. 1993; 49♂, 1♀, ditto, 1-25. VI. 1993; 1♂, 1♀, Nonsan, 1-16. VII. 1991; 2♂, ditto, 25. V. 1992; 1♂, ditto, 5. VII. 1992; 1♂, ditto, 1. IX. 1992; 1♀, Yesan, 3. IV. 1973; 1♂, ditto, 28. VI. 1980; 2♂, ditto, 11. VI. 1992. GB- 9♂, 2♀, Andong, 10. V. 1988; 1♂1♀, ditto, 2. VII. 1988; 2♂, Bonghwa, 25-29. VI. 1992; 2♂, ditto, 4-18. VII. 1992; 1♂,

Euiseong, 16. VII. 1992; 1♀, Gimcheon, 3. VII. 1987; 3♂, Hadong, 21. VI. 1991; 1♂, Mt. Taebaeg, 16. VI. 1974; 29♂, Yecheon, 1-15. VI. 1991; 1♀, Yeongdeog, 27. VII. 1992. GN- 1♂, Geochang, 26. VIII. 1992; 1♂, Jinyang (Jinju), 1. VI. 1991; 2♂, ditto, 1. VII. 1991; 1♂, Sacheon, 20. V. 1986. JB- 1♂, 1♀, Gimje, 21. VII. 1991; 1♂, Jinan, 1. VII. 1991; 2♂, 2♀, Muju, 1-16. VII. 1992. JN- 1♂, Damyang, 21. VI. 1992; 1♂, Goheung, 1. VI. 1991; 1♂, ditto, 6. XI. 1991; 5♂, ditto, 9. VI. 1992; 1♂, ditto, 1. VII. 1992; 4♂, Hakuyosan (Mt. Baegyang, Jangseong), 25. VI. 1922; 2♂, Is. Heugsan, 16-20. VII. 1975; 1♂, Is. Soheugsan, 20. VI. 1973; 5♂, 1♀, Yeongam, 11-21. VI. 1991. JJ- 1♂, Bugjeju, 20. X. 1984; 1♂, Is. Jeju, 7. VII. 1985; 2♂, 2♀, ditto, 30. VI. 1987; 1♂, ditto, 30. V. 1988; 1♂, ditto, 19. VI. 1988; 1♂, Namjeju, 11. VI. 1992; 1♀, Seogwipo, 8. VII. 1984; 8♂, 3♀, ditto, 10-12. VII. 1985; 9♂, 3♀, ditto, 10. VIII. 1987. KPNU: GG- 1♂, Ganam, Icheon, 3. VII. 1978; 2♂, Geumdang-ri, Icheon, 3. VII. 1978; 1♂, Gwangreung, 23. V. 1970; 1♂, Mt. Myeongji, 7. VI. 1976; 1♂, ditto, 26. V. 1978; 1♂, Mt. Nam, Seoul, 27. VI. 1971; 2♂, ditto, 5. VII. 1972; 1♂, Seoul, 19. VII. 1971. GB- 1♂, Mt. Juwang, 13. VII. 1978; 1♂, Mt. Naeyeon, 2. VII. 1972; 3♂, ditto, 12. VII. 1978; 1♂, Punggi, 29. VI. 1978; 4♂, Is. Ulreung, 8-10. VII. 1978; 1♂, ditto, 20. VI. 1982; 5♂, ditto, 18. IV. 1983. JN- 1♂, Mt. Jiri, 29. V. 1977. CIS: GG- 1♂, Mt. Myeongji, 13. VI. 1989. JJ- 3♂, Mt. Hanra, 5. VII. 1986; 1♀, Yongdugol, 5. VII. 1986.

Distribution. Korea, Japan, China, Taiwan, Sakhalin.

Remarks. In comparison with the Japanese specimens, Korean specimens are generally smaller in length. So it is valid that Korean group can be a new subspecies. Type material is preserved in the collection of Institut Royal des Sciences Naturelles de Belgique, Belgium (IRSNB).

***Melanotus insularis* Lee et Woo, 1999** 섬빗살방아벌레

Melanotus insularis Lee, 1999: 15-18.

Specimens examined. NIAST: JN- 11♂, 1♀, Is. Soheugsan, 20-28. VI. 1973; 1♂, ditto, 27. VI. 1974.

Distribution. Korea (South).

Remarks. This species resembles a Japanese species, *M. senilis* but can be distinguished by the state of body punctures and longitudinal line of pronotum. The paramere of lateral lobe in male genitalia is also different from that of the Japanese species.

***Melanotus nuceus* Candèze, 1881** 밤빗살방아벌레

Melanotus nuceus Candèze, 1881: 89; Heyden, 1887: 257.

Distribution. China, Tonkin, North Vietnam, and Korea.

Remarks. No specimens of this species is available. This species was described originally from central China by Candèze (1881). And Heyden (1887) reported this species in Korea for the first time, but the locality was not described exactly. Since then, there has been no record until now. In personal

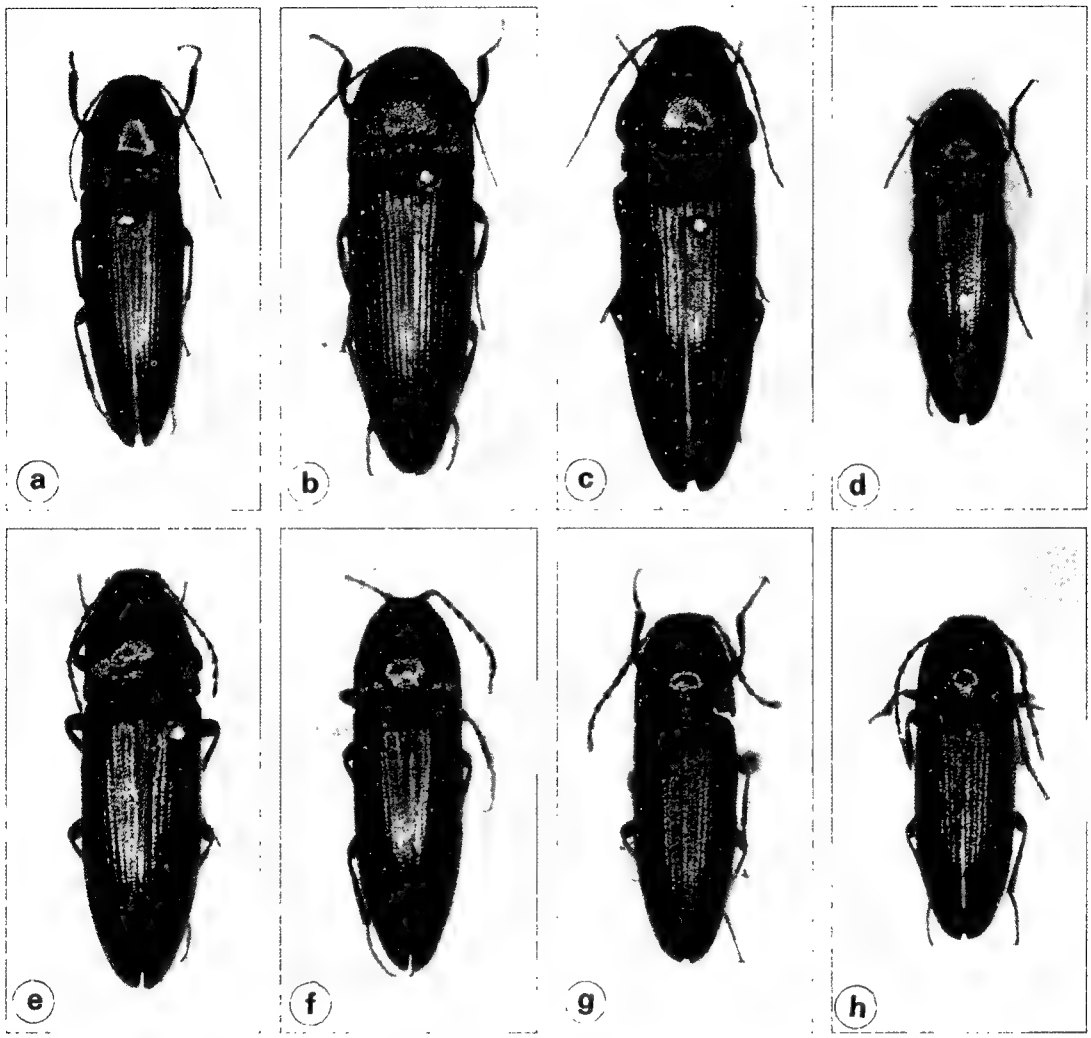

Fig. 3. Adult of genus *Melanotus*, male: a. *M. legatus*; b. *M. suwonensis*; c. *M. propexus*; d. *M. augustianus*; e. *M. niger*; f. *M. hallasanae*; g. *M. coreanus* sp. nov.; h. *M. chejuensis* sp. nov.

communication, Dr. Platia gave us an information that he also could not find the specimens of this species from Korea although he had examined all specimens from Far East in Berlin and Paris Museum.

***Melanotus annosus* Candèze, 1864** 재털빗살방아벌레

Melanotus annosus Candèze, 1864: 48; Miwa, 1933: 158; Cho, 1963: 49; Chu, 1969: 112; Lee *et al.*, 1985: 407.

Melanotus (*Melanotus*) *annosus*: Ohira, 1971: 24.

Distribution. Korea and Japan.

Remarks. Miwa (1933) reported this species in Korea for the first time by the specimen collected from Suweon by Satô on July 30th, 1930. Thereafter, another locality Cheju Island was added by Hirashima (1989). This species is common in Japan, whereas it seems to be very rare in Korea. Otherwise, Miwa and other Japanese authors might have made mistakes because this species has very similar external characteristics with *Melanotus carbonarius* and *M. woonhahi*. One female syntype is preserved in BMNH.

***Melanotus carbonarius* Candèze, 1881** 가는빗살방아벌레

Melanotus carbonarius Candèze, 1881: 88; Lee, 1995: 73-82.

Specimens examined. GG- 1♂, Jemulpo, ?, G. Hauser in coll. Zool. Mus. Berlin. NIAST: JJ- 1♂, Aewol, 25. V. 1992.

Distribution. Korea (Incheon, Is. Jeju) and China (N. China).

Remarks. In 1992, Dr. Platia sent us a specimen collected by Hauser from Jemulpo, Korea and stored in Zoological Museum of Berlin, Germany. we also collected one more specimen from Aewol, JJ, in 1992.

***Melanotus woonhahi* Lee et Woo, 1999** 운하빗살방아벌레

Melanotus woonhahi Lee, 1999: 15-18.

Specimens examined. NIAST: GG- 2♂, Suweon, 19. V. 1959; 2♂, ditto, 15. V. 1962; 1♂, ditto, 3. VI. 1963.

Distribution. Korea (Suweon).

Remarks. This species is similar to *M. senilis* Candèze, 1965, but the body size is smaller, antennae shorter and the punctures of whole body a little smaller and more sparse than *M. senilis*. Male genitalia is also different.

***Melanotus niger* Lee, 1998** 곰보빗살방아벌레

(Figs 3e, 4e)

Melanotus niger Lee, 1998: 103-108.

Specimens examined. NIAST: GG- 1♂, Koryo (Gwangreung), 10. IV. 1923; 1♂, Suweon, 1. V. 1970. JN- 1♂, Haenam, ?. VII. 1988. KPNU: GW- 1♂, Daegwanryeong, ?. VIII. 1987; 4♂, Mt. Gariwang 2. VI. 1991; 1♂, Mt. Obong, 20. V. 1982; 2♂, Mt. Seolag, 16-28. VI. 1978; 1♂, ditto, 4. VI. 1981; 1♂, ditto, 23. V. 1989. GG- 1♂, Mt. Bughan, Seoul, 16. VII. 1976; 2♂, ditto, 29. V. 1983. CB- 1♂, Mt. Sogri, 9. VI. 1977. GB- 1♂, Mt. Juheul, 5. VI. 1983; 3♂, Mt. Palgong, 26-29. V. 1985; 1♂, Mt. Taebaeg, 17. VI. 1974. GN- 1♂, Mt. Gaya, 15. VI. 1974. JB- 2♂, Mt. Deogyu,

28. V. 1991. JN- 1♂, Mt. Jiri, 12. VI. 1983. CIS: GW- 1♂, Chunseong (Chuncheon), 5. VI. 1989; 1♂, Hongcheon, 20. V. 1988; 1♂, Sogeumgang, 24. V. 1988. GG- 1♂, Mt. Myeongji, 13. VI. 1989.

Distribution. Korea (South).

Remarks. This species is similar to *M. correctus* common in Japan, but more robust in external shape. Male genitalia is also very different from the Japanese species. The punctures on the surface of body are more large and distinct.

***Melanotus augustianus* Lee, 1998** 건석빗살방아벌레

(Figs 3d, 4d)

Melanotus augustianus Lee, 1998: 103-108.

Specimens examined. KPNU: GB- 1♂, Mt. Palgong, 6. VI. 1985. JN- 1♂, Mt. Jiri, 18. VIII. 1989.

Distribution. Korea (South).

Remarks. This species resembles *M. niger*, but body size is small and distinguished easily by the brown body colour.

***Melanotus hallasanae* Lee, 1998** 한라빗살방아벌레

(Figs 3f, 4f)

Melanotus hallasanae Lee, 1998: 103-108.

Specimens examined. KPNU: JJ- 4♂, Mt. Hanra, 2. VI. 1989.

Distribution. Korea (Is. Jeju).

***Melanotus erythropygus* Candèze, 1873** 끝빨간빗살방아벌레

Melanotus erythropygus Candèze, 1873: 20; Miwa, 1933: 70; 1933: 158; Doi, 1938: 95; Chu, 1969: 112; Lee *et al.*, 1985: 407.

Melanotus invectitius Lewis, 1894 (nec Candèze): 182-201.

Melanotus (*Kensakulus*) *erythropygus*: Ohira, 1971: 24.

Distribution. Japan and Korea.

Remarks. This species was originally described from Japan. Miwa (1933) reported this species for the first time from Korea. After then, Doi (1938), Chu (1969) and Lee *et al.* (1985) reported from Gaema-Plateau and Mt. Hanra, but we could not find any specimen in Korea. This species is very similar to the common species in Korea, *M. caudex* and *M. coreanus* sp. nov. We examined only Japanese materials. Eight syntypes are preserved in BMNH.

***Melanotus coreanus* Lee, sp. nov.** 꼬마빗살방아벌레 (신칭)

(Figs 1a, 1b, 1e, 2f, 3g, 4g)

Description. Male. (7.5–9.2)/(2.2–2.6) mm BL/BW. Body small and fusiform, widest at elytral humeri. Colour black, but legs and antennae reddish brown. Pubescence ash-colour, a little recumbent.

Head a little convex above, depressed at anterior part just behind the fore margin; fore margin rounded and well-carinated; disc (surface) punctured clearly and densely; interocular area about 6 times (1.2: 0.2 mm) as broad as the width of each eye in dorsal view; frontal groove (nasal area) broad, weakly narrowed in the middle with yellow band between clypeus and frontal groove. Clypeus convex.

Antennae very long, at least last two segments exceed the hind angles of pronotum; first segment

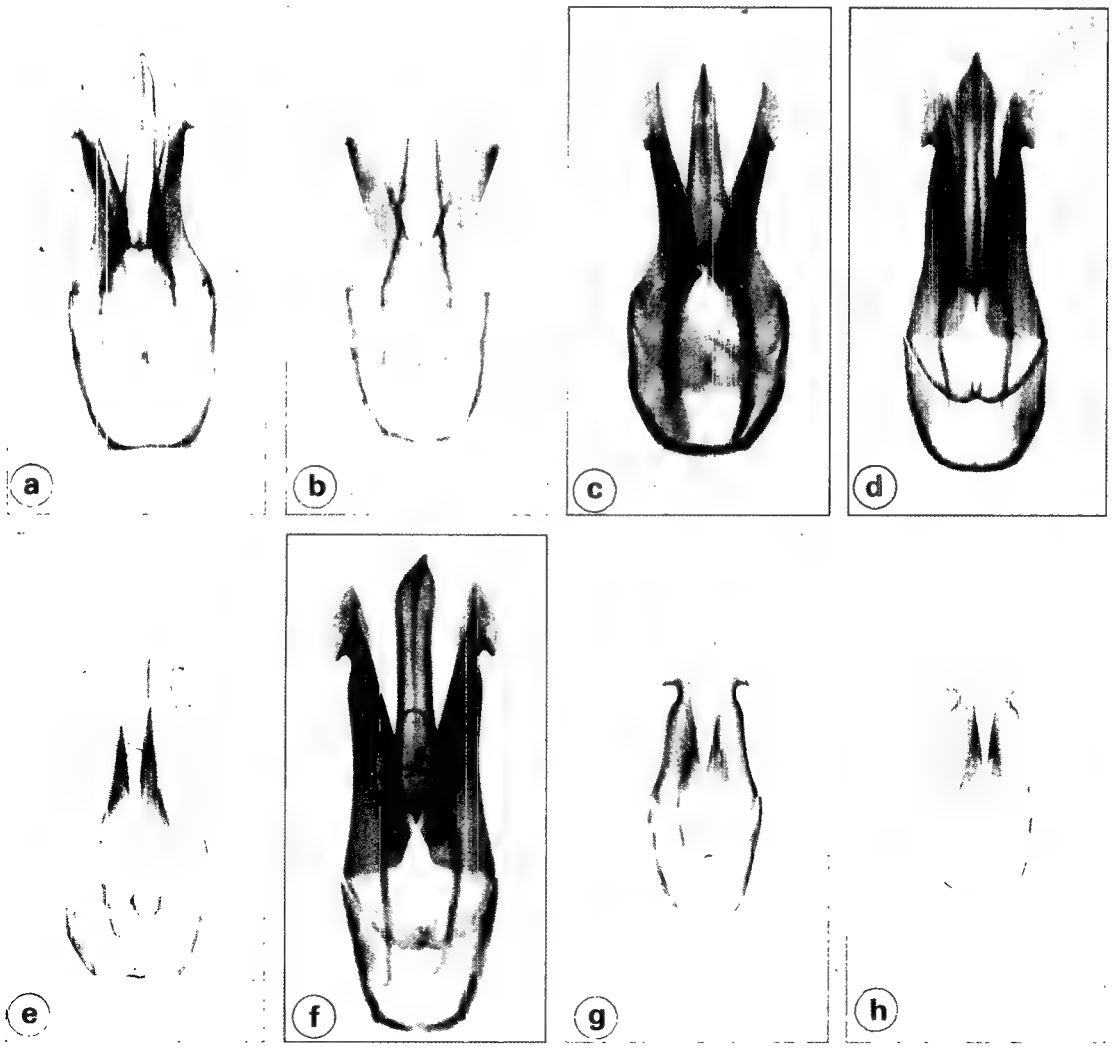

Fig. 4. Male genitalia of genus *Melanotus*: a. *M. legatus*; b. *M. suwonensis*; c. *M. propexus*; d. *M. augustianus*; e. *M. niger*; f. *M. hallasanae*; g. *M. coreanus* sp. nov.; h. *M. chejuensis* sp. nov.

elongate oval; second (0.14/0.14 mm L/W) and third (0.16/0.14 mm L/W) globular and short, as long as wide; fourth (0.39/0.26 mm L/W) triangle, 1.5 times as long as wide, 2.4 times as long as third; fourth to tenth segment serrate, gradually narrowing apically; eleventh (0.63/0.19 mm L/W) elongate subfusiform, but a side of apico-lateral portion depressed, about 3.3 times as long as wide.

Pronotum weakly convex above; widest at base, sides subparallel at basal half, then gradually convergent anteriorly; medio-longitudinal length (1.9/2.4 mm L/W) shorter than the width in the middle; hind angles projected backward, sides parallel, each bears a carina, the length of carina 0.5 mm, apex pointed sharply; surface punctured densely; interspaces between punctures smooth and shining; sublateral basal furrow shallow.

Scutellum sub-quadrangle, sides parallel, anterior margin truncated, but the posterior margin rounded; relative median length and basal width as 0.35/0.3 mm L/W; surface flattened and wrinkled without puncture.

Elytra widest at humeri, sides parallel at basal 2/3, then gradually narrowing posteriorly; relative sutural length including scutellum and humeral width as (5.5/2.4 mm L/W); basal margin substraight; strial furrows deep with periodical punctures; strial interstices a little convex and wrinkled without distinct puncture.

Prosternum broad and subtrapezoid, convex medio-longitudinally; prosternal sutures double-lined, each grooved at anterior 2/3. Prosternal process bent strongly behind the procoxal cavity, well ridged medio-longitudinally, rounded apically. Propleura truncated posteriorly. Hind coxal plate strongly enlarged inward without tooth. Claws of legs 7 conspicuous teeth.

Male genitalia (Fig. 4g); relative length of median lobe and lateral lobe as 0.69/0.63 mm M/L; parameres expanded apico-laterally, the lateral apex of expansion pointed sharply and post-laterally; relative length and width of expansion as 0.19/0.13 mm L/W. Apex of median lobe pointed narrowly.

Types. Holotype: 1♂, Mt. Gwanggyo, GG, 6. V. 1955, NIAST. Paratypes: NIAST: GG- 1♂, Mt. Gwanag, 22. V. 1987; 1♂, Gwangreung, 29. V. 1983; 1♂, Hwaseong, 19. IV. 1976; 1♂, Jinbu, 15. VIII. 1986; 1♂, ditto, 15. VIII. 1987; 1♂, Songchu, 16. V. 1975; 1♂, Mt. Suri, 22. IV. 1976; 1♂, Suweon, 7. V. 1970; 1♂, ditto, 7. V. 1972; 1♂, ditto, 6. VII. 1982; 1♂, Mt. Taehwa, 23. V. 1982; 1♂, Yangji, 14. V. 1970; 1♂, ditto, 15. VI. 1987; 1♂, Yongin, 21. V. 1989. CB- 1♂, Mt. Weolag, 20. VI. 1984. CN- 1♂, Cheongyang, 12. V. 1987. KPNU: GW- 1♂, Mt. Obong, 21. V. 1982. GG- 1♂, Mt. Bughan, Seoul, 11. V. 1972; 1♂, ditto, 29. V. 1983; 1♂, Mt. Cheonma, 2. V. 1978; 1♂, Is. Ganghwa, 11. V. 1982; 1♂, Namhansanseong, 2. V. 1976. CN- 2♂, Mt. Gyeryong, 24. V. 1989. GB- 3♂, Mt. Juheul, 5. VI. 1983; 3♂, Mt. Palgong, 26-28. V. 1985. JB- 1♂, Mt. Deogyu, 28. V. 1991. CIS: GW- 2♂, Chuncheon, 4-12. V. 1985; 1♂, ditto, 16. V. 1987; 1♂, Mt. Samag, 8. V. 1989. GG- 1♂, Exp. Forest, Seoul, 13. V. 1987. SNU: GW- 1♂, Mt. Odae, 21. V. 1991. GG- 1♂, Anyang, 27. V. 1986; 1♂, Banweol, 16. V. 1986; 1♂, Gwangju, 9. V. 1992; 1♂, Mt. Gwanggyo, 31. V. 1986; 1♂, ditto, 27. IV. 1991; 1♂, Mt. Myeongji, 5. V. 1991; 2♂, Suweon, 4-9. III. 1990. JN- 1♂, Mt. Jiri, 15. V. 1990. GB- 1♂, Mt. Sobaeg, 2. V. 1992. Four more paratypes are preserved in the collection of Dr. Platia as follows. GW- 1♂, Mt. Odae, 17. VII. 197?. GG- 2♂, Suweon, 20-23. V. 1959. CB- 1♂, Jincheon, 23. V. 1981.

Distribution. Korea (South, Central).

Etymology. We named as *M. coreanus* because this species was very common in Korean Peninsula.

Remarks. This species is similar to *M. caudex*, but body size is a little smaller and male genitalia is different in the shape of apical barbs of lateral lobe.

***Melanotus chejuensis* Lee, sp. nov.** 제주꼬마빗살방아벌레 (신칭)

(Figs 3h, 4h)

Description. Male, (7.9-8.0)/(2.4-2.5) mm BL/BW. Body small and fusiform, widest at elytral humeri. Colour black and shining; legs and antennae reddish brown. Pubescence ash-colour, recumbent posteriorly.

Head a little convex above, frontal margin rounded broadly; surface punctured densely and clearly; interocular distance about 7 times as broad as the width of each eye in dorsal view. Frontal groove shallow, weakly narrowed in the middle. Clypeus convex, longitudinal length very short.

Antennae very long, at least last two segments exceed the hind angles of pronotum; first segment elongate and globular with many obscure punctures on surface; second (0.13/0.14 mm L/W) and third (0.16/0.14 mm L/W) small and globular, but third a little long and more dilated apically, the total length of second and third segments shorter than fourth; fourth (0.42/0.25 mm L/W) elongate triangle, about 1.7 times as long as wide, 2.6 times as long as third; fourth to tenth segment serrate, gradually becoming longer apically; eleventh slender and long, narrowed apically, about 4.1 times as long as wide (0.66/0.16 mm L/W).

Pronotum convex above, sides subparallel at basal half and gradually convergent anteriorly, medio-longitudinal length almost as long as wide in the middle (2.0/2.2 mm L/W); posterior angles projected backward and pointed sharply, each bears a carina, the length of carina 0.6 mm; surface punctured weakly, interspaces between punctures smooth and shining; sublateral furrow deep and short.

Scutellum jar-shaped, sides and posterior margin rounded, surface convex in the middle with some obscure punctures, relative median length and humeral width as 0.4/0.3 mm L/W.

Elytra; sides subparallel at basal 2/3, then gradually convergent to apex; relative sutural length including scutellum and humeral width as 5.5/2.4 mm L/W; strial furrows deep with distinct and periodical punctures; strial interstices a little convex and shining with many small punctures.

Prosternum convex medio-longitudinally, surface punctured weakly, interspaces between punctures smooth; prosternal sutures double-lined, each grooved anterioly; prosternal process abruptly bent inward at the procoxal cavity. Propleura truncated posteriorly under the apex of pronotal hind angle, surface shining with elongate vestigial punctures. Hind coxal plate gradually enlarged inward without tooth. Claws of legs equipped with 5 conspicuous teeth.

Male genitalia (Fig. 4h); relative length of median lobe and lateral lobe as 0.6/0.54 mm M/L; parameres expanded apico-laterally the lateral hook of the expansion round; relative length and width of expansion as 0.16/0.13 mm L/W, apex of median lobe convergent gradually.

Types. Holotype: 1♂, near Manjang-gul, JJ, 11. V. 1982, KPNU. Paratypes: KPNU: JJ- 2♂, near Manjang-gul, 11. V. 1982.

Distribution. Korea (Is. Jeju).

Etymology. This species was named as *M. chejuensis* according to the name of place, Cheju Island from which the type series were collected.

Remarks. This species is very similar to *M. caudex*, but different for the following points; antennae more elongate, fourth to eleventh segments more narrow and slender, punctures of pronotum small. Also, the genitalia is different in the apical barbs of lateral lobes.

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韓國産 빗살방아벌레亞科(방아벌레科, 딱정벌레目)의 分類學的 硏究 (I): *Melanotus*屬

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韓國産 빗살방아벌레亞科(Melanotinae)의 표본을 同定하고 기록 문헌을 정리한 결과 총 18種이 확인되었다. 그 중 *Melanotus*屬으로는 *M. chejuensis* sp. nov.와 *M. coreanus* sp. nov.을 포함하여 11種이 확인되었다. 新種에 대하여 記載하고 각 種들의 성충 및 수컷생식기 寫眞과 함께 각 屬, 種들에 대한 檢索表를 작성하여 보고한다.

검색어 : 딱정벌레목, 방아벌레과, 빗살방아벌레아과, *Melanotus*속, 분류, 한국

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